Claims

What is claimed is:

1. A method for delivery of molecules into biological cells, comprising the steps of:

obtaining electrodes in an electrode assembly, wherein the electrodes have fixed electrode surfaces which are coated with at least one static layer of electrode releasable molecules to be delivered,

obtaining a waveform generator for generating electric fields,

establishing electrically conductive pathways between the electrodes and the waveform generator,

locating the electrodes such that the biological cells are situated therebetween, and

providing electric fields in the form of pulse waveforms from the waveform generator to the electrodes, such that molecules in the at least one static layer of the electrode releasable molecules on the electrodes are delivered into the biological cells.

2. The method of claim 1, further including the step of

attaching the electrode assembly having the statically coated electrodes to an electrode assembly holder for establishing electrically conductive pathways between the electrodes and the waveform generator.

3. The method of claim 1 wherein the electrode releasable molecules 44 include electric field separable molecules.

4. The method of claim 1 wherein the electrode releasable molecules 44 include solvent separable material.

5. The method of claim 1 wherein the electrode releasable molecules 44 include electric field separable molecules and solvent separable material.

6. The method of claim 1 wherein the fixed electrode surfaces 42 includes a water-insoluble polymer.

7. The method of claim 1 wherein the fixed electrode surfaces 42 include a water-insoluble polymer and a water-soluble polymer.

8. The method of claim 1 wherein an electrode surface itself serves as a fixed electrode surface.

9. The method of claim 1 wherein the fixed electrode surfaces include an oxidized metal surface.

10. The method of claim 1 wherein the fixed electrode surfaces include fixed metal particles.

11. The method of claim 1 wherein the fixed electrode surfaces include roughened surfaces.

12. The method of claim 1 wherein the electrode releasable material on the fixed electrode surfaces includes a gel coating.

13. The method of claim 1 wherein the electrode releasable material on the fixed electrode surfaces includes a solid layer of nonpolymeric material.

14. The method of claim 1 wherein the electrode releasable material on the fixed electrode surfaces includes a polymer layer.

15. A method for treating tissue cells, including the steps of:

(a) obtaining statically-coated electrodes which are statically-coated with molecules of an electrode releasable tissue treating agent,

(b) inserting the statically-coated electrodes into a tissue to be treated,

(c) releasing molecules of the electrode releasable tissue treating agent from the electrode, and

(d) applying electroporation pulses to the electrodes such that the released molecules of the electrode releasable tissue treating agent are driven into cells in the tissue.

16. The method of claim 15 wherein the tissue to be treated is skin tissue.

17. The method of claim 15 wherein the tissue to be treated is deep organ tissue.

18. The method of claim 15 wherein the tissue to be treated is muscle tissue.

19. The method of claim 15 wherein the molecules of the electrode releasable tissue treating agent are released from the electrodes by applying electrophoretic pulses to the electrodes.

20. The method of claim 15 wherein the molecules of the electrode releasable tissue treating agent are released from the electrodes by contacting the electrodes with a solvent.

21. A method for immunotherapy, including the steps of:

(a) obtaining statically-coated electrodes which are statically-coated with an immuno-stimulating material,

(b) inserting the statically-coated electrodes into a tissue to be treated,

(c) releasing the immuno-stimulating material from the electrode, and

(d) applying electroporation pulses to the electrodes such that the released immuno-stimulating material is driven into cells in the tissue.

22. The method of claim 21 wherein the immuno-stimulating material is released from the electrodes by applying electrophoretic pulses to the electrodes.

23. The method of claim 21 wherein the immuno-stimulating material is released from the electrodes by contacting the electrodes with a solvent.

24. The method of claim 21 wherein the immuno-stimulating material is released from the electrodes by contacting the electrodes with a solvent which includes body fluids.

25. An electrode which includes a coating having at least one static layer of electrode releasable molecules to be delivered into biological cells.

26. A plurality of electrodes of claim 25 which form an electrode assembly.

27. The electrode assembly of claim 26 wherein said plurality of electrodes are arranged in at least two parallel rows of electrodes.

28. The electrode assembly of claim 27 wherein said parallel rows of electrodes include needle electrodes.

29. The electrode of claim 25 wherein said molecules in said static coating are in a solid phase.

30. The electrode of claim 25 wherein said molecules in said static coating are in a gel.

31. The electrode of claim 25 wherein said electrode includes a fixed electrode surface which is coated with said static layer of electrode releasable molecules.

32. The electrode of claim 31 wherein:

said fixed electrode surface 42 includes a fixed surface matrix, and

said molecules in said static coating are in a liquid fixed on said fixed surface matrix.

33. The electrode of claim 31 wherein said fixed electrode surface includes solid surface particles.

34. The electrode of claim 33 wherein said solid surface particles are metal particles.

35. The electrode of claim 31 wherein said fixed electrode surface includes a liposome matrix.

36. The electrode of claim 31 wherein said fixed electrode surface includes a solid polymer matrix.

37. The electrode of claim 25 wherein said molecules in said static coating are macromolecules.

38. The electrode of claim 25 wherein said macromolecules in said static coating include a polynucleotide vaccine.

39. The electrode of claim 25 wherein said macromolecules in said static coating include a solid phase polynucleotide vaccine.

40. The electrode of claim 25 wherein said macromolecules in said static coating include a DNA vaccine.

41. The electrode of claim 25 wherein said macromolecules in said static coating include a solid phase DNA vaccine.

42. The electrode of claim 25 wherein said macromolecules in said static coating include an RNA vaccine.

43. The electrode of claim 25 wherein said macromolecules in said static coating include a solid phase RNA vaccine.

44. The electrode of claim 25 wherein said macromolecules in said static coating include a protein-based vaccine.

45. The electrode of claim 25 wherein said macromolecules in said static coating include a solid phase protein-based vaccine.

46. The electrode of claim 25 wherein said macromolecules in said static coating include an organ treating agent.

47. The electrode of claim 46 wherein said organ treating agent includes a deep tissue tumor treating agent.

48. The electrode of claim 25 which is in a form of a needle electrode.

49. The electrode of claim 25, wherein coating of said electrode with said static layer of molecules to be

delivered to the biological cells is carried out by the following steps:

preparing a liquid medium in which a quantity of said molecules are carried,

contacting said electrode with the prepared medium, and

removing said electrode from the medium and drying off the medium, such that a static coating of said molecules remains on said electrode.

50. The electrode of claim 25 wherein coating of said electrode with said static layer of molecules to be delivered to the biological cells is carried out by the following steps:

preparing a liquid medium in which a quantity of said molecules are carried,

contacting said electrode with the prepared medium,

applying pulse waveforms to said electrode, such that a portion of said molecules are bound to said electrode, and

removing said electrode from the medium and drying off the medium, such that a coating of said molecules remains on said electrode.

51. An apparatus for delivery of molecules into biological cells, comprising:

a waveform generator which provides pulse waveforms,

an electrode assembly holder, and

an electrode assembly which is mechanically supported by said electrode assembly holder and which is electrically connected to said waveform generator through electrically conductive pathways, wherein said electrode assembly includes electrodes which are coated with at least one static layer of electrode releasable molecules to be delivered into the biological cells.